

CLAIMS

1. A method of driving an ultrasonic transducer having a piezoelectric resonator formed by a pair of electrodes sandwiching a piezoelectric body and provided with a backing layer contacting with one of the electrodes of the piezoelectric resonator and having the same acoustic characteristic impedance as the piezoelectric body, the method comprising the step of driving so as to satisfy a condition:

$$2T_h \leq T_d \leq 6T_h$$

where T_h is a propagation time of an ultrasonic wave in the piezoelectric body sandwiched by the pair of electrodes, and T_d is a pulse width of a drive pulse driving the piezoelectric resonator.

2. The method of driving an ultrasonic transducer according to Claim 1,

wherein a setting is determined so as to satisfy a condition:

$$T_d < (2L_2 + L_1)/V$$

where L_1 is a thickness of the piezoelectric body sandwiched by the pair of electrodes, L_2 is a thickness of the backing layer, and V is a sound speed when an ultrasonic wave propagates in the piezoelectric body and the backing layer.

3. The method of driving an ultrasonic transducer according to Claim 1 or Claim 2,

wherein when a pair of the ultrasonic transducers are disposed opposite with sandwiching a substance to be an ultrasonic transmission target, a setting is determined so as to satisfy a condition:

$$(R^2 + X^2)^{1/2} - X > (VM \times Td)$$

where X is a distance between both of the opposite ultrasonic transducers, 2R is a length of a short side or a diameter of an ultrasonic wave emission surface, VM is a sound speed of an ultrasonic wave propagating in the substance, and λ is a wavelength of the ultrasonic wave propagating in the substance, represented by $\lambda = (VM \times Td)$.

4. The method of driving an ultrasonic transducer according to any one of claims 1 to 3,

wherein when there is a partition wall made of a substance different from a substance of an ultrasonic wave emission surface of the piezoelectric resonator and a substance to be a target of ultrasonic transmission therebetween, a setting is determined so as to satisfy a condition:

$$Td < 2Lw/Vw$$

where Lw is a thickness of the partition wall, and Vw is a sound speed when an ultrasonic wave propagates in the partition wall.

5. The method of driving an ultrasonic transducer according to Claim 4,

wherein a setting is determined such that an acoustic characteristic impedance of the partition wall has a value between an acoustic characteristic impedance of the piezoelectric resonator and an acoustic characteristic impedance of the substance to be a target of ultrasonic transmission.